Picotrack
User Manual

Version 2.3

Picotrack

Picotrack Power

Picotrack IP69K

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1 Introduction

The Picotrack is small sized tracking device which is well suited for tracking valuable goods and shipments. The Picotrack is suited for a wide range of asset tracking applications including the following (this list is not exhaustive!):

- Tracking of valuable goods and shipments (Product prototypes, cash transport, high value products)
- Tracking product packaging (e.g. pallets & crates…)
- Mobile industrial equipment

Because of the multitude of possible application we cannot list them all. Therefore we will only refer to installation scenarios as they occur in asset tracking applications.

The Picotrack device is available in the following versions:

- Picotrack: For all applications where smallest dimensions are essential and there is the possibility to frequently recharge the device.
- Picotrack Power: Just 1 mm thicker than the standard Picotrack. It is suited for all applications where the smallest dimensions are essential and a longer battery lifetime is required.
- Picotrack IP69K: The Picotrack Power is provided inside an IP69K grade casing, which is can also be supplied with a magnet (as optional accessory) for quick installation on metallic surfaces. It is suited for all applications where long battery lifetime is needed and the device is subjected to harsh environmental conditions.

2 Delivery content

The standard delivery includes the Picotrack device. The delivery could include furthermore some of the following accessories, depending on the details of your purchase order:

Accessory Name	Order code	Functionality	Picture
USB-A / Micro-USB-B-Cable	17005	Use this cable only to charge the device (but not for configuring it).	
Cable for Config-Tool Picotrack	16207	User this cable to charge or to configure the device via the Telic Config-Tool	
Picotrack power supply w/o USB-cable	17003	Use this power adapter to connect the device to a mains supply.	
Picotrack Cigarette lighter charger w/o USB-cable	17004	This cable allows to connect the device to a cigarette lighter	
Magnet plates for Picotrack IP69K	17020	Used for installation on metallic surfaces	

Table 1: Accessories List

3 Technical Data

The following table lists key technical parameters for the products:

Components	Picotrack	Picotrack Power	Picotrack IP69K
Dimensions	57x38x15 mm	57x38x19 mm	95x50x39 mm
Connectors	Charging cable		
Environmental Rating	N/A	N/A	IP69k protected
Status LEDs	3 indicators for the states: GSM, GPS, On/Off, battery charging/full, DOTA, On/Off button…		
GSM/GPRS module	Quadband-GSM-Module at 850 MHz / 900 MHz / 1800 MHz / 1900 MHz.		
GPS Sensitivity (Tracking)	-165 dBm		
GPS Acquisition Time	Cold ~ 34sec ; Warm ~ 33 sec ; Hot < 1 sec		
GPS Tracking / Acquisition Channels	22/66 channel		
Battery	660 mA/h	1320 mA/h	1320 mA/h
Message Logging Capacity	2800		
Sleep mode average consumption (GPS+GSM off)	0,07 mA		
GSM/GPS antennas	Both integrated		
Operating Temperature	-20°C to +60°C		
Recharging Temperature	0°C to +45°C		
Supply voltage	5V USB	5V USB	5V USB
Weight	40 g	50 g	100 g
Certificates	CE, ROHS		

Table 2: Technical Data

4 Operation Setup

The operation set-up of the Picotrack device can be realised in few quick steps.

	Please take proper measures for ESD protection (e.g. electrical connection of the body to ground) to make sure you do not destroy internal electronics! Repair of ESD damages caused by user's negligence will not be covered by Telic's warranty. Electrostatic discharge (ESD) is the sudden and momentary electric current that flows between two objects at different electrical potentials normally caused by static electricity.

4.1 Opening the device

Open Picotrack housing by screwing off the housing (as shown in the following Figure). The SIM card holder is under the battery and allows to slide-in and to fix a standard Mini-SIM card. Be careful when moving the battery not to pinch the battery cable.

Figure 1: How to open the device

4.2 Inserting the SIM Card

A working SIM card from a suitable network provider must be correctly inserted in order for the device to operate correctly.

	The messages of the Picotrack are transmitted via the mobile GSM network. Therefore you need a standard 3 Volts or 1.8 Volts SIM card. Please give preference to post-paid SIM cards!

Please put the device in front of you on your desk so that you can slide-in the SIM card (as shown in the following Figure); the gold contacts of the SIM card must be facing down. The SIM card must be pushed in the direction of the arrow, until it snaps into place.

Figure 2: How to inserting the SIM Card

	The opposite cover of the housing, in which the GPS receiver is embedded, should not be opened, to avoid a contamination of the receiver which may lead to a reduction of receiving quality (should you be forced to clean the pad sometime, please do so using pure alcohol).

Before the Picotrack logs into the mobile GSM network, it checks whether the used SIM card is PIN free. If it is PIN free, it will start normal operation.

If the SIM card is not PIN free, it has to be assured, that the PIN is set to “0000” before it has been inserted. The PIN can be changed e.g. with a normal GSM mobile phone to “0000”.

To speed up the log-in into the GSM network, the SIM card should not contain any phone book entries.

4.3 Closing the housing

	Make sure that the battery is not damaged or squeezed by the holder of the housing while closing the device, and that the battery cable is not pinched or kinked. Avoid any stress on the micro USB connector when it is plugged in the Picotrack. In the worst case, the connector of the Picotrack board could be damaged. Telic’s warranty does not cover the repair of this type of damage.

Close the device again and take care that the housing covers fit together tightly and properly.

4.4 Switching the device ON and OFF

Telic delivers the devices switched OFF.

- **To switch the device ON:** push the red button until the green LED of the left GSM-indicator lights up.
- **To switch the device OFF:** device push the red button twice in quick succession. Note that the green LED of the left GSM indicator will continue to light-up for a while, even though the switch-off process is on its way.

Figure 3: Switch the device off

	Pushing the red button will always be confirmed by the red LED in the centre indicator, which means it will be illuminated as long as the button is being pushed.

4.5 Status Indicators

Internally the device has three status indicators each indicator has 2 or 3 different colored LEDs closed grouped together.

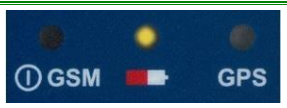
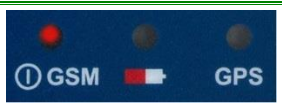
Left indicator: GSM status	Middle Indicator: Power supply status	Right Indicator: GPS status
The left indicator reflects the GSM status and also, whether the device is switched on.	The middle indicator reflects the status of the integrated battery as well as of the DOTA download.	The right indicator reflects GPS reception as well as the device reset status.
When the LED is off, the device is switched off	The middle LED being off does NOT mean that the device is switched off. It only indicates that the device is not connected to external power supply.	Off: GPS is not switched on
Permanently on: GSM is switched on, but no GSM network is available. Blinking once: the device is logged into the GSM network. Blinking twice: TCP/IP connection to the server has been established	Permanently on: the device has external power supply and the battery is fully charged.	2 times blinking: 2D- Fix (no valid height and the position may be imprecise 3 times blinking: 3D (GPS data are complete
		
	Permanently on: the battery is currently charging. The middle indicator works identically if the device is in sleep mode; just the left and the right indicators are off.	1 time blinking: position acquisition not possible
		
Slow double blinking: the SIM card is not readable (e.g. if not correctly inserted into the SIM cardholder or others). After a certain period of time the Picotrack will switch-off completely (as it would be after pushing twice the red on/off button).	The red LED is permanently on during the whole DOTA (Download Over The Air) procedure.	About 5 seconds red during device reset

Table 3: Status indicators

5 Troubleshooting hints

5.1 The device doesn't show any sign of life

Possible issue source	Trouble shooting
The device is not switched on	Press once the red on/off button to turn the device on.

Table 4: The device doesn't show any sign of life

5.2 The device doesn't log into the GSM network

Possible issue source	Trouble shooting
The device isn't in a GSM covered area	Please check whether there is GSM reception in this area (e.g. using a cell phone) and move eventually to another area.
The position of the Picotrack device is not favourable.	Choose another place in the vehicle which might be less shielded.
The SIM card in the Picotrack device is new and has not yet been activated	Please check, whether the SIM card is already activated. This can be done e.g. by putting the SIM card into your cell phone and checking, whether your cell phone is able to log into a GSM network.
The SIM card has been locked by the provider	Please check whether the SIM card is locked. This can be done e.g. by putting the SIM card into your cell phone and checking, whether your cell phone is able to log into a GSM network. If this not the case, then please try to make a phone call. If you are successful, the SIM card is definitely not locked.
The prepaid bonus is exhausted	Please recharge the SIM card in the Picotrack device.
The prepaid SIM card is no longer valid	If they aren't recharged on a regular basis (often after 12 or 24 months). In this case usually you have to buy a new SIM card.
The PIN code of the card has not been deactivated or is not set to "0000"	Please remove the SIM card from the device and check the PIN code. The Pin code has to be deactivated or set to "0000" After a triple wrong entry of the PIN, unblocking the SIM card requires the PUK.
The SIM card hasn't been inserted into the SIM card holder in the correct way	Please check the correct position of the SIM card in the card holder.

Table 5: The device doesn't log into the GSM network

5.3 The device doesn't log into the GPRS network

Possible issue source	Trouble shooting
The GPRS service is not yet activated	Please ask your provider, whether the GPRS function is already activated for the SIM card in use.

Table 6: The device doesn't log into the GPRS network

5.4 The device doesn't send messages

Possible issue source	Trouble shooting
Battery of the device was completely drained (e.g. after several weeks of storage)	Please recharge the device and wait for 3D GPS fix to synchronise the internal real time clock.

Table 7: The device doesn't send messages

5.5 The device doesn't receive GPS data

Possible issue source	Trouble shooting
The position of the device is not favourable for the GPS reception	Please check, whether the device has the indicators facing up and a clear view of the sky.
The GPS receiver has no free sight to the sky	Please be aware, that a GPS receiver operates most efficiently when there is a clear view of the sky. Please ensure that the device side with the LEDs has free view to the sky.
Your asset is placed in an unsuitable location	Please consider that a GPS reception operates most efficiently when there is a free view of the sky. If GPS reception is not available (e.g. due to location of the asset inside a warehouse), considering using the Device-based Wireless Positioning feature as an alternative positioning method (see Section 7.4).

Table 8: The device doesn't receive GPS data

Further hints regarding sources of errors are indicated through the 8 LEDs of the 3 indicators, which are easily visible from outside. You will find details of the meaning of the different colours and blinking signs in Section 0 (“

Status Indicators”).

6 Basic Features

The device can be configured either via serial cable by using the Telic Configuration tool or remotely via SMS and GPRS. Please contact the Telic support team to receive more details about the configuration procedure.

6.1 Event Types

The Picotrack's primary task is to transmit GPS positioning data as well as additional status information via a TCP/IP connection to the tracking server. If a message can't be transmitted, it will be stored in the device for transmission at a later point in time. There is a storage capacity of about 1.000 position messages. The following events will generate a positioning message which always contains the GPS position:

- **Time event:** the end of a time period of x seconds (x being configurable).
- **Distance Event:** after a distance of x meters (straight line distance to the previous event) in any direction (x being configurable) has been travelled.
- **Angular change Event:** a direction change of a configurable minimum angle in x degrees (x being configured) at a configurable minimum speed of y km/h (y being configurable).
- **Power event:** Switching on or off the device.

6.2 Connection Establishment Procedure

The GSM and GPS modules will power up after switching on the Picotrack device. After logging in into the GSM network the Picotrack will attempt to establish a GPRS communication link. Finally a TCP/IP connection to the tracking server will be established to transmit the event messages.

The selection of the GSM network operator will take about 1 minute, plus the time to build up the GPRS- and TCP/IP-connections to the tracking server. Therefore, after switching on the device, it will take approximately 2-3 minutes until the first status message can be transmitted. Independent of this procedure, GPS positions and status information will be generated and stored in the internal memory for later transmission. Here follows the message structure:

6.3 Event Message Structure

The first identified and valid GPS position will be taken as the reference position for the distance interval calculations. The next distance interval event will be generated if the configured distance has been reached. If another event (e.g. time interval event) has been generated before, the distance interval measurement starts again at the position of this new event. That means that any position message with an actual GPS position sets a new reference for the distance interval calculations. This reduces the number of messages sent while still keeping the desired resolution of the tracking application.

A position message will also be generated in the case of a direction change being greater than the configured angle while travelling at the configured minimum speed.

Switching on and off the external Power supply (e.g. ignition on/off) also leads to an event message. The last valid position will be transmitted when no new valid GPS position is available.

Content	Description
Event/Log –Code	Reason for the status message
Event/Log Timestamp	Time at which the event has happened
GPS Timestamp	GPS timestamp at the moment of fetching longitude and latitude
Longitude	Degree of longitude (default: in 100µ degrees; can be decreased to 1µ degrees precision)
Latitude	Degree of latitude (default: in 100µ degrees; can be decreased to 1µ degrees precision)
Fix Type	1,2 or 3, depending on the availability of satellites in view having a sufficient signal strength: ▪ 1D Fix (no valid data) ▪ 2D Fix (no height indication) ▪ 3D Fix (position message with height indication) ▪ 6 (GSM Tracking; must be activated in the device)
Speed over ground	Speed in km/h
Satellites for calculation	Actual number of satellites which are used for calculation
Height	Height above sea level (in m)
Mileage	Mileage in meters
DigIns	4 digits e.g. 0010, if charger is connected
Analog Input 1	Value of the analogue input 1, i.e. Battery voltage with a precision of 1/10 volts
MotSens	Status of the motion sensor

Table 9: Content Description

7 Advanced Features

This section describes some advanced features supported by the device, which might be required for different use cases.

7.1 Geofencing

Geofencing (an electronic safety fence) provides the opportunity to set a geographic square around a defined location. Here you can configure different events like “leaving the area” or “entering the area” to be transmitted to the control centre. Up to 50 geofence areas can be monitored, which can also be combined to create larger areas and build up complex protection zones. Every geofence area is given an Area ID, a centre (defined by its longitude and latitude) and a height and width (from the centre not completely across) in meters.

Figure 4: Geofencing

7.2 Roaming alternative configuration

The device is able to detect a GSM roaming status and swap automatically to an alternative setup for roaming (this alternative setup has to be previously configured). This allows optimizing the data traffic and reducing the communication costs.

7.3 Device Watchdogs

The Picotrack has different integrated watchdogs. They automatically check the functions of the device and generate resets as soon as they recognise any malfunction. Malfunction could occur due to internal problems of the device, problems related to the GSM connection, problems with the GPS reception and many more.

This watchdog concept ensures that the Picotrack can automatically return to stable operation if necessary. Control of the watchdogs by the user is not necessary.

If the watchdog has to restart the device it may happen that some of the position messages and respectively events are not logged and as a result they are not transmitted to the tracking server.

7.4 Device-based wireless positioning

The device can be configured in order to get a localization obtained by the GSM module, in case that the GPS has some difficulties providing a valid fix. Of course this position will be less accurate and take a bit longer than the standard way by GPS module, therefore this functionality has to be considered as a fallback for the GPS.

8 Device Installation on Board

In order to protect your goods from theft and vandalism the device should be installed in a location where it is well-hidden. Please install the device in a suitable, dry location, not in contact to radio and audio frequency interference or hot parts of the good. Be aware to observe ESD (Electro Static Discharge) protection measures. When installing the device consider that antennas are integrated, this means it must be installed in a place with a minimum distance of 7 cm within a minimum 180 ° cone of the patch antenna to any metallic components of the good in each direction. In order to optimize the quality of the signal received, the surface of the internal GPS internal antenna must be installed skywards.

The unit can also be placed on the lateral side of the Asset or even below it if the optimal installation described above is not possible. Consider, though, that this might have the following effects:

- Reduction of the device's battery life time due to the GPS module requiring more time and higher power consumption to get a fix.
- Less precise fix. The accuracy of the fix might be affected by reflections of the GPS signals. It is advisable to configure in such cases the unit to perform 2D fixes.
- No fix possible. In this case, it is possible to get a rough position by device-based GSM tracking, but the battery lifetime of the unit will also be adversely affected.

9 Safety

The following guidelines must be followed in order to ensure the safety of users. If these rules are ignored Telic will not assume responsibility for any damages that are incurred.

9.1 General Battery handling

The Picotrack main power source is a battery with high energy capacity. These rechargeable batteries are designed to provide the highest possible degree of safety. They may, however, present a potential hazard if they are abused electrically or mechanically. This is in most circumstances associated with the generation of excessive heat. In this case the internal pressure may cause the cell case to rupture.

Consequently, the following general guidelines should be followed when handling the Picotrack Battery:

- Do not short-circuit
- Do not over discharge
- Do not incinerate
- Do not expose to temperatures beyond the specified temperature range
- Do not crush or puncture
- Do not open cells, do not disassemble battery packs
- Do not expose contents to water
- Do not connect with false polarity
- Do not weld or solder to the battery's body

It is very important that only authorized official Telic replacement batteries be used in the Picotrack. Also the batteries included with the devices are only tested or authorized for use in the Picotrack. The batteries should never be used in any other devices unless specifically authorized by Telic, including but not limited to other Telic products or devices.

9.2 Battery storage

Batteries should be stored in rooms with generally low temperature and low humidity levels. While it is not essential that these storage areas be temperature and humidity controlled, temperatures should generally be kept below 35 °C and storage areas should be well ventilated. Storage temperatures above 75 °C should be avoided.

Your Picotrack batteries should be stored in their original packaging materials or in the Picotrack itself. This will eliminate unintentional short-circuiting. Do not store batteries in conductive anti-static bags or foam unless the resistivity of the material exceeds 1 MΩ. Batteries should not be placed on or covered with metallic or otherwise conductive material.

Batteries should be stored away from any flammable material in the storage area. Fire extinguishers for metal fire (class D) are preferred. Do not attempt to extinguish fires with small amounts of water, sand, or with carbon dioxide extinguishers.

9.3 Battery Disposal

The disposal or recycling of batteries is regulated by each European country. In each country, the manufacturers, importers and users are responsible for proper disposal. The European Community (EC) has issued two directives, 91/157/EEC and 93/86/EEC. These directives are implemented by each member country of the EC independently and in a different way. In accordance with these directives, the Picotrack batteries do not contain dangerous substances. The reaction products are inorganic and do not represent environmental risks once the decomposition process has terminated.

10 General Terms and Conditions

All information in this documentation has been carefully assembled and checked, but should not be considered as a guaranteed feature set. The copyright of the related documentation is with Telic GmbH.

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11 Compliance Statements

11.1 CE Declaration of Conformity

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CE Konformitätserklärung
CE Declaration of Conformity

Hiermit erklären wir, dass die folgenden Produkte
Hereby we declare that the following products

Picotrack (Product ID: 0108)
Picotrack Power (Product ID: 0109)
Picotrack IP69K (Product ID: 0105)

den folgenden Normen und Richtlinien entsprechen:
comply with the following European standards and regulations:

Nummer / Kurztitel *Number / Title*	Eingehaltene Vorschriften *Observed regulations*	
R&TTE-Richtlinie 99/5/EG EMV-Richtlinie 2004/104/EG *R&TTE-Directive 99/5/EG* *EMV- Directive 2004/104/EG*	ETSI EN 301489-1 V1.8.1: 2010	*Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;* *Part 1: Common technical requirement*
	ETSI EN 301489-7 V1.3.1: 2006	*Electromagnetic compatibility and Radio spectrum Matters (ERM) - ElectroMagnetic Compatibility (EMC) standard for radio equipment and services - Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)*
	EN 300440-2 V1.2.1: 2007	*Electromagnetic compatibility and Radio spectrum Matters (ERM) Short range devices - Radio equipment to be used in the 1 GHz to 40 GHz frequency range* *Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive*
	EN 60950-1:2006	*Safety of information technology equipmen*
	ETSI EN 301 511 V9.0.2: 2003	*Global System for Mobile communications (GSM); Harmonized EN for mobile stations in the GSM 900 and GSM 1800 bands covering essential requirements of article 3.2 of the R&TTE directive (1999/5/EC)*

Oberhaching, den 30.06.2014

Frank Heineck

12 Document History

Revision	Date	Changes
Rev. 2.0	15/03/14	First release on new layout
Rev. 2.1	21/05/14	Update Status indicator
Rev. 2.2	26/05/14	Update Technical Data
Rev 2.3	11/07/14	Update Section 11

Table 10: Document History